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Lila San Roque*, Kobin H. Kendrick, Elisabeth Norcliffe
and Asifa Majid

Universal meaning extensions of perception verbs are grounded in interaction

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Abstract: Apart from references to perception, words such as *see* and *listen* have shared, non-literal meanings across diverse languages. Such cross-linguistic meanings have not been systematically investigated as they appear in their natural home — informal spoken interaction. We present a qualitative examination of the semantic associations of perception verbs based on recorded everyday conversation in thirteen diverse languages. Across these diverse communities, spontaneous interaction provides evidence for two commonly-discussed extensions of perception verbs — perception~cognition, hearing~linguistic communication — as well as illustrating other meanings and functions (e.g., the use of perception verbs as discourse markers) that have been less appreciated heretofore. The range of usage that is readily observable in informal conversation makes it clear that this type of data must take center stage for the empirically grounded study of semantics. Moreover, these data suggest that commonalities in polysemous meanings may rely not only on universal cognition, but also on the universal exigencies of social interaction.

Keywords: perception verb, conversation, polysemy, sociality, discourse marker, diversity, semantics

1 Introduction

Words have multiple meanings and contexts of use. In English one can speak of a *sharp* knife but also of a sharp taste, sound, or movement, each of which

***Corresponding author: Lila San Roque**, Radboud University, Nijmegen, The Netherlands; Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, E-mail: l.sanroque@let.ru.nl
Kobin H. Kendrick, University of York, Heslington, UK, E-mail: kobin.kendrick@york.ac.uk
Elisabeth Norcliffe, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands; SOAS, University of London, E-mail: en6@soas.ac.uk
Asifa Majid, Radboud University, Nijmegen, The Netherlands; Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands; University of York, Heslington, UK, E-mail: asifa.majid@york.ac.uk

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evokes a different but related sense of sharpness. Polysemy — broadly speaking, the possibility for a word to have several related interpretations — is thought to be a feature of all linguistic systems (e.g., Rabagliati et al. 2010), psychologically real (e.g., Pykkänen et al. 2006), and integral to language change (e.g., Wilkins 1981; Sweetser 1990; Evans and Wilkins 2000). Examples of polysemy have been cited as evidence for both culture-specific and universal conceptual structures (e.g., Sweetser 1990; Evans 1992), and as revealing general communicative and cognitive motivations for semantic stasis and change (e.g., Regier et al. 2016; Xu et al. 2017). Within the cross-linguistic study of polysemy, the language of perception has received particular attention, as it represents the intersection of our common physiological basis for experience on the one hand, and the bountiful variety of human linguistic and cultural systems on the other (e.g., Howes 1991; Classen 1997). It thus provides good purchase to examine how both cultural and biological forces shape the lexicon, provided that diverse languages are studied (Evans and Wilkins 2000; Majid and Levinson 2011; Majid et al. in press). In this study we take a cross-linguistic approach to polysemy that is grounded in conversational data, allowing us to further contemplate the possible role of “the interaction engine” (Levinson 2006) as a third powerful influence on how words expand their semantic and pragmatic range.

Polysemy is a linguistic habit practiced by everyone, every day. Take extended uses of English perception verbs as an example. It is common parlance to talk about *hearing from* someone who in fact made contact through a visual medium such as email; or to start a sentence with a peremptory *Look*, where no literal looking is required. Spontaneous spoken language is central to polysemy, as new senses of a word are thought to begin as products of pragmatic inference in interaction, and, through repeated instances, come to stick around as distinct meanings (Wilkins 1981; Sweetser 1990; Traugott and Dasher 2002; Jansegers et al. 2015). Face-to-face conversation is also of considerable interest as regards the language of perception: conversation is a forum that enables interlocutors to calibrate and negotiate immediate perceptual experience through language; or, from a learner’s perspective, match linguistic labels to qualia (Dahl 2000; Levinson and Majid 2014). To date, however — owing in part to the scarcity of available corpora — semantic associations in informal conversation are understudied, particularly from a cross-linguistic perspective. In this paper, we ask what connections in form and meaning are, in fact, evoked in (and by) everyday interaction, and whether we observe similar patterns across diverse languages.

We aim to contribute to the study of polysemy and the language of perception in three ways. First, building on a prior study of lexical frequency (San Roque et al. 2015), we showcase a procedure for the cross-linguistic study of polysemy in informal conversation. Second, we detail the semantic and

pragmatic associations of perception verbs as found in conversational data from 13 languages, including five major national or international languages and eight under-studied indigenous languages of the Americas, Asia, Africa, and the Pacific. Third, we highlight “discourse” extensions of perception verbs that are not usually considered in the same context as referential polysemy. In doing so, we show that conversational data (as per Jansegers and Gries 2017; Kendrick in press) point with renewed energy to the role of sociality in common extensions of perception verbs across languages and cultures. The cross-linguistic study of everyday talk can illuminate the intersubjective rationale for widespread semantic and pragmatic extensions of sensory language (e.g., those to do with cognition and attention) and empirically demonstrate that very general patterns (such as the typical uni-directionality of “intrafield” extensions) are nevertheless grounded in very particular moments of linguistically and culturally situated interaction. Informal conversation, with all its social and contextual baggage, thus emerges alongside individual cognition as a potential facilitator and arbiter of “universal” semantic relations.

1.1 Where is polysemy?

Synchronic studies of polysemy that focus on a single language or several closely related languages employ a wide range of data-gathering techniques, for example, dictionary searches, elicitation, and participant observation, as well as examining contextualized written or spoken examples (see, e.g., Alm-Arvius 1993; Enfield 2003; Aikhenvald and Storch 2013). For languages with a long tradition of literacy and established broadcast media (and often thanks to committed individuals who work towards creating accessible electronic corpora), polysemy can be approached using quantitative corpus linguistics techniques (e.g., Gries 2006; Glynn and Robinson 2014), parallel translation (e.g., Enghels and Jansegers 2013; Wälchli 2016), and with a growing range of tools and resources (e.g., FrameNet; Mapping Metaphor 2015). Lexicographic, elicitation, introspective, and usage-based work can further be combined with psycholinguistic and neurolinguistic inquiry (see, e.g., Gries 2015), and semantic mapping approaches (e.g., Haspelmath 2003).

Informal dyadic or multi-party talk is rarely the sole focus of polysemy studies. An alternative approach to the multi-functionality of words and particles — which relies almost exclusively on interactional data — comes from conversation analysis (e.g., Clift 2001; Heritage 2015). This approach generally emphasises sequential action (e.g., what is being done in this turn in the conversation, and how does this relate to prior and subsequent turns?)

rather than lexical semantics; and sometimes rejects the notion of “polysemy” as enshrining a view of decontextualised meaning at the expense of interactional practice (Mazeland and Huiskes 2001: 165; see also Depperman 2011 concerning semantic study in conversational analysis more generally). Several studies in the conversation analytic tradition (or loosely based upon it) have examined discourse uses of perception verbs, discussed below. In a similarly interaction-focused vein, Nerlich and Clarke (2001) argue that polysemy is itself an important resource in conversation, while first language development researchers have examined meanings and functions of perception verbs in conversations involving children (see San Roque and Schieffelin *in press*).

Broader cross-linguistic inquiries into polysemy have by tradition and necessity largely focused on data from dictionaries and questionnaires. For example, for each language in a study, a linguist might look up (and cross-check) a word that relates to the target concept (e.g., ‘hear’) in a dictionary, and/or ask native speakers or other language experts whether this word can also have such-and-such a meaning (e.g., Vanhove 2008; Youn et al. 2015). Recent projects have also made use of automated extraction of data from multiple dictionaries and databases (e.g., the CLICS database of cross-linguistic colexifications, List et al. 2014). However, dictionary definitions cannot always capture all current senses of a word (e.g., Fillmore and Beryl 2000), and meta-linguistic intuition varies across speakers. These difficulties can be exacerbated when working with smaller, under-studied languages, as the coverage of available materials varies widely (e.g., Ross et al. 2016: 7–8), and the number of native speakers who are available to advise on their language may be limited. Some parallel corpora may be available for many languages, but relevant words and contexts may be absent from such texts (Wälchli 2016), and differing translation practices and versions bring their own problems (Christodoulouplos and Steedman 2015). Corpora of interactional language are difficult and time-consuming to create, and as such make only rare appearances in cross-linguistic studies of lexical polysemy. Yet we know that informal conversation can differ from other linguistic genres in various ways (e.g., Biber 1986; Dahl 2000), and that differences across genres can relate specifically to perception and related domains (e.g., the frequency of perception verbs as discourse markers, Romero Trillo 1997; differences in the expression of stance and evidentiality, Zariquiey 2015; the frequency of lexical items that relate to certain sensory modalities, Divjak 2015; Winter et al. 2018).

Here, we complement existing work by examining perception verb polysemies as found in conversation, the primary site of language use and language change (Levinson 2006). Through work with a specialized corpus (created by the

authors and the researchers named in Figure 1) we enhance the ecological validity and linguistic diversity of polysemy studies. Conversation is the main form of discourse that is shared by all language-culture groups, and gives the opportunity to ground claims in people's day-to-day linguistic experience. Moreover, by studying informal talk we can gather contextualized examples in comparable discourse that represent both well-known languages and smaller under-studied languages for which sizeable written and broadcast media-based corpora do not exist, and, in many cases, probably never will.

1.2 Perception verbs and their meanings

Basic perception verbs often have additional meanings that do not refer to literal sensory experience, also known as “transfield meanings” (following Matisoff 1978).¹ Such meanings are often presented as metaphorical extensions from embodied physical experience to more abstract domains, although some examples may speak more to the idea of metonymic rather than strictly metaphorical extension (cf. also Traugott and Dasher 2002). We use *transfield* for situations where we observe a linguistic association between perception and another semantic domain. Generally, we follow François' (2008) “colexification” approach, in that we remain largely agnostic as to whether polysemy or semantic vagueness is the true characterization for each individual perception verb discussed.

The semantic domain of cognition is especially relevant to perceptual polysemies. Sweetser (1990) proposed that cognition is linked to the faculty of vision — over and above the other senses — so that sight words will commonly be found in reference to cognitive states and processes (such as knowing, understanding, deducing, etc.). In contrast, Evans and Wilkins (2000) found that many Australian languages link audition most strongly to cognitive processes (see also Vanhove 2008). Others have suggested that additional sensory domains (e.g., smell, Storch 2013) have cognition-related meanings. Accommodating the idea that the individual senses most emblematic of cognition show cultural variability, Ibarrexe-Antuñano's (2008) proposed a more general ‘understanding-is-perceiving’ association, arguing that perception verbs are routinely used to convey notions of comprehension and

¹ We acknowledge that in some languages, terms may more appropriately be analyzed such that both core perception and other meanings are “primary” (rather than always thinking of a perception verb as being “extended” to include an additional sense). See, e.g., Pawley (1994), Evans and Wilkins (2000), Koptjevskaja-Tamm (2008), François (2008), and Aikhenvald and Storch (2013), for discussion. See also Wälchli (2016) for discussion of the distinction between cognitive and perceptual processes as regards the semantics of perception verbs.

knowledge cross-linguistically (see also Viberg 1983: 157–158). Another potentially universal polysemy pattern is that hearing verbs extend to meanings that concern linguistic communication (e.g., ‘obey’) through the common association of audition and the reception of speech (Sweetser 1990; Evans and Wilkins 2000; Vanhove 2008). It has not previously been tested whether the proposed universality of cognitive and communicative meanings is observable in spontaneous language use in different communities.

The semantic associations of perception verbs are, of course, not limited to cognition and linguistic communication. The languages investigated here add in particular to the burgeoning research on the polysemy of multi-sense verbs (e.g., Enghels and Jansegers 2013; Jansegers et al. 2015), and demonstrate the value of examining verbs of touch, taste and smell, which are yet to receive the same level of scrutiny as sight and hearing verbs (Burenhult and Majid 2011; Ibarretxe-Antuñano 2006; Wälchli 2016; see also Classen 1997).

As well as associating with other semantic domains, perception verbs can be discourse markers that regulate interaction and manage interpersonal relations. For several European languages, especially Romance and Germanic, there is a rich field of inquiry into the discourse functions of basic perception verbs in spoken language (e.g., Brinton 2001; Fagard 2010). Individual forms have been described as serving a wide range of tasks, for example directing the attention of the addressee to upcoming talk (e.g., Romero Trillo 1997; Waltereit 2002), encoding politeness (Chodorowska-Pilch 2008), launching courses of action (Sidnell 2007), expressing apology or adversity (Enghels and Jansegers 2013; Jansegers and Gries 2017), and making claims of evidential vindication (Kendrick in press). These functions tend to go beyond our traditional understanding of polysemy (see discussion in Jansegers and Gries 2017) as they do not always exemplify a change in meaning so much as an extension to a specialized interpersonal function (although, this general path of subjectification or pragmaticization is of course well-explored in regard to language change more generally).

Beyond Germanic and Romance languages, discourse uses of perception verbs are certainly reported (e.g., Aikhenvald 2010: 247; Levinson 2010: 2744; Thanassoula 2013: 257) but are less often a focus of research. Again, this is especially the case for touch, taste, smell and multi-sense verbs. Overall, discursive practices with perception verbs demonstrate the importance of perceptual language as a tool for testing or demonstrating common ground and a shared reality (Dahl 2000; Majid and Levinson 2011), but it remains unclear how widespread and entrenched such practices are, and what cross-linguistic patterns exist (Fedriani et al. 2012; Majid 2013).

Finally, this study also examines *intrafield* extensions of perception verbs in conversation — that is, where a word that pertains to one perceptual modality is

used to talk about another perceptual modality (see also a related literature on “synaesthetic metaphor”, springing from Ullmann 1945 and Williams 1976). From a diachronic perspective, Viberg (1983) argued that (at least with regard to certain verb classes) intrafield sense extensions were likely to be unidirectional, moving from higher to lower on a proposed hierarchy of the senses (see > hear > touch, taste, smell). For example, a verb meaning ‘see’ could shift over time to (also) mean ‘hear’, but not vice versa. Subsequent research has tended to support this claim (Evans and Wilkins 2000), although exceptions have also been identified (e.g., Maslova 2004; Nakagawa 2012). From a synchronic perspective, one is struck by Viberg’s under-explored suggestion that intra-field meanings become possible where a perception verb is used with *transfield* meaning (1983: 140–141), and we examine this idea further here.

We now introduce our language sample and procedures for compiling and analyzing the data (Section 2), describe the transfield, discourse and intrafield meanings of perception verbs found therein (Section 3), and then turn to discussion of our findings (Sections 4–5).

2 Data and methods

2.1 The database

Data from informal naturally-occurring conversation were collated from thirteen languages from nine language families (Figure 1). These families are: Austronesian (Whitesands), Barbacoan (Cha’palaa), Duna-Bogaia (Duna), Indo-European (English, Italian, Spanish), Mayan (Tzeltal), Mon-Khmer/Austroasiatic (Semai), Niger-Congo (Avatime, Siwu), Sino-Tibetan (Chintang, Mandarin) and Tai-Kadai (Lao). This was a convenience sample selected on the basis of available data and expertise, with an emphasis on the inclusion of lesser-described indigenous languages.² Such languages make up more than half of the group, alongside five national or international languages (English, Italian, Lao, Mandarin, Spanish).

² For future research, an Australian language or languages would be a valuable addition, as it has been shown that many Australian languages do not manifest a dominant semantic association between sight and intellection (Evans and Wilkins 2000). The inclusion of signed languages would also be of great importance, for example, concerning how modality of language can affect extensions of vision and hearing verbs.



Figure 1: Languages featured in this study, with names of the contributing researchers. The corresponding database was first reported in San Roque et al. (2015).

The investigators named in Figure 1 provided transcripts and coding for each language. To do so, they drew on long-term fieldwork with the relevant community, having worked in collaboration with (other) native speakers to record, transcribe, and translate conversational material. This is time-consuming and challenging work, in many cases made more so by a dearth of prior language description and difficult field conditions. Such difficulties, indeed, go partway to explaining the low representation of conversational corpora in cross-linguistic study (cf. Floyd et al. in press).

Each language contributed six video-recorded conversation segments of approximately 10 minutes each (i.e., an hour in total), primarily of interlocutors in domestic settings. The samples are comparable in that they cover people's daily interactions doing typical activities such as chatting, preparing food, engaging in craft activities, and so on. Further details about the sampling procedures can be found in San Roque et al. (2015).

For each language, the relevant investigator(s) identified a set of perception terms according to Viberg's (1983) method (allowing complex predicates as well as simple verbs), so each of the five sense modalities (sight, hearing, touch,

taste, smell) was represented by one or more terms.³ Seven languages in the sample (Avatime, Duna, Italian, Semai, Spanish, Tzeltal, Whitesands) have a multi-sense term in their core perception vocabulary, described and discussed in §3.4. For the purposes of this study, words that refer only to internal sensation, temperature, proprioception and/or emotion were not considered.

Perception terms were located in the sample, and the conversational turn in which the term occurred was entered into a database. For each example, researchers provided a free translation into English of the whole utterance and of the perception term. Each item was coded for a number of features (see San Roque et al. 2015) including the sense modality of the lemma (sight, hearing, touch, taste, smell, multi-sense) and whether it had a discourse function in this context; that is, if in this instance it appeared to be serving a primarily discourse-oriented purpose in the conversation, such as directing the attention of the addressee to upcoming talk.

The number of perception tokens noted in each language varied considerably; for example, the Cha'palaa hour included fewer than 50 basic perception verbs, whereas the Avatime sample included nearly 180. This is likely to affect the number of polysemies observed in each language. In addition, verbs of vision were by far the most frequent, accounting for 75–85% of the basic perception verbs used (see San Roque et al. 2015), except in Tzeltal, where the multi-sense verb was almost twice as frequent as the vision verb. Apart from Tzeltal, then, additional meanings for vision are likely to be the best represented here, potentially as a genuine reflection of how meaning and form are distributed (i.e., there is likely a relationship between frequency and number of meanings, as per Zipf 1945; Winter et al. 2018).

Taking all of this into consideration, the database allows us to draw conclusions about the presence of meanings across languages and modalities, but not their absence. Furthermore, given the sample, quantitative comparisons between sensory modalities or languages would be inappropriate. However, we believe the qualitative approach of the following sections provides rich

³ Viberg's (1983) schema distinguishes between three semantic components: activity (e.g., *She listened to the crickets*), experience (*She heard the crickets*) and copulative (*The crickets sounded loud*). Several of the languages in our study do not distinguish between activity and experience (indicated by including two English terms, e.g. 'listen/hear', in the interlinear gloss line), and several do not have 'copulative' perception verbs. We do not analyze our data in relation to these distinctions. See further Evans and Wilkins (2000) concerning the decision to exclude copular expressions in their survey of Australian languages; and Aikhenvald and Storch (2013), and Wälchli (2016) for critical discussion of Viberg's categories. However, we note their relevance for future work (see, e.g., the findings of Tanghe and Jansegers 2014).

insights into perception verb usage in everyday talk, and does so for diverse communities worldwide in an unprecedented manner.

2.2 Identifying polysemies

To investigate transfield meanings of perception words, we began in phase one with a bottom-up approach, looking at the “free translations” provided by researchers for each example. We collapsed different grammatical forms of the same verb (e.g., the separate translations ‘think’ and ‘thinking’) as one item and grouped semantically similar items together, examining the original context where necessary to understand the meaning. The groupings were made independently by four native English speakers (the authors), with discrepancies then resolved by consensus, resulting in the groups of meanings shown in Table 1. As sight verbs were the most frequent, semantic associations to them dominate. The first group (gathered under the label COGNITION) includes items that were considered cognition-related concepts. Items concerning focused attention, including scrutiny, assessment, and careful attentiveness – for example, to potential danger – form a second group (ATTENTION). Other recurrent themes identified in the free translations were socializing, locating, trying, and co-identification. Several of these have been identified in the literature as common extensions of perception verbs, and we include a selection of relevant references in the Supplementary Materials. Linguistic communication did not emerge as a single grouping during this process, but – as we shall see – meanings relevant to this domain were distributed across several of the existing groups. Meanings that occurred only once or that were judged not to belong to a particular group were noted and set aside for later investigation.

Table 1: Recurrent semantic associations of perception verbs.

Recurrent association	Meanings (using English as a meta-language) included in this group
COGNITION	understand, think, know (about), believe, figure out, find out, deduce, remember, imagine, realize, discover
ATTENTION	check (on/over/out), scrutinize, inspect, examine, assess, review, watch out/over, be careful, pay attention to, look after, heed
SOCIALIZING	meet, come together, visit
LOCATING	look for, search (for), find, locate
TRYING	try, test, try out, attempt
CO-IDENTIFICATION	consider to be (something), regard as (something)

In phase two, for each meaning group, researchers were asked to re-examine the one-hour sample and identify examples where a sight, hearing, and/or multi-sense term was used with one of the meanings listed in the second column of Table 1. This process confirmed the presence of candidate meanings in the data, and allowed for clearer comparison across languages, as everyone used the same criteria (and the same proxy meta-language, English) for the identification of polysemies. Researchers were also asked to identify examples of any polysemies for verbs of any sense modality that were *not* included in the meaning groups shown in Table 1. This ensured we did not miss less frequent sense extensions. Where there were discrepancies between “singleton” meanings identified in phases one and two, these were checked again in consultation with the relevant researcher(s).

We took a broad interpretation of polysemy in relation to both meaning and form: when determining the presence of an extended semantic association, we did not require a literal sensory meaning be *impossible*, but only that an extended reading (also) be present. As such, many of the cases represent a kind of “bridging context” (Wilkins 1981), where the item can be understood with both literal and extended meanings; for example, when *see* means ‘meet, interact with’, the situation that is so described typically involves literally seeing a person, as well as the additional social meaning. Furthermore, we included meanings that were vested in constructions as well as in individual words, counting both “loose” and “strict” colexification (François 2008). As an example, English *look for* is counted as a locating meaning of a vision verb in our survey, even though this is a lexicalized verb + preposition combination; and serialization of the Duna vision verb to mean ‘attempt to...’ is counted as a trying meaning, even though this is constructional (see Horie 1993; Vesterinen 2010; Jansegers et al. 2015, *inter alia*, concerning complementation and the semantics of perception verbs). We also allowed cases where the specialized meaning was largely inseparable from explicit or implicit contextual elements (e.g., meanings to do with social interaction generally only arise when both arguments of the verb are human).⁴

Two further types of extended uses of perception verbs were examined in detail. First, discourse uses were identified according to their function, and a

⁴ For future work, it may be valuable to develop cross-linguistically applicable criteria that reliably separate “bridge” cases (i.e., where we see the potential for both a literal and additional inferable meanings) from those where a literal perception meaning is excluded, and to distinguish between different types of polysemy (e.g., lexical, constructional, and contextual). This would be informative for tracking the development and maintenance of specific meanings. For now, we cast our net widely and do not attempt such fine-grained distinctions.

subset of instances examined with close reference to their context. Second, potential intrafield extensions of perception verbs were located according to the lemma and the perception meanings specified for each token, and re-confirmed with the relevant expert(s).

In the results that follow, we give an overview of transfield semantic associations and then present discourse uses for each modality: sight (Section 3.1), hearing (Section 3.2), touch, taste, smell (Section 3.3) and multi-sense verbs (Section 3.4). Finally, we discuss intrafield extensions (Section 3.5). While each meaning found in the database merits discussion and investigation in its own right, we limit ourselves to a few illustrative examples of cognition, attention, discourse, and intrafield extensions. Representative examples of all other meanings found in this investigation, as well as some notes on corresponding or similar meanings reported for other languages in the literature, are given in the Supplementary Materials for this paper.

3 Results

3.1 Sight

Sight verbs around the globe furnished a rich array of extended meanings. We first outline the crosslinguistic trends, and then detail meanings that were found in only one language, before examining discourse uses. (Additional examples of sight verbs are shown in Supplementary Materials S1–S16.)

Meanings to do with cognition were present in all 13 languages. Example (1), from Avatime, gives an illustration. The sight verb *mò* ‘see’ was used in the context of deduction and discovery, treating visual experience as equivalent to gaining knowledge. In this case, the knowledge concerns the results of a (hypothetical) autopsy. A negative form of *tè* ‘know’ in the first clause is contrasted with a positive version of *mò* ‘see’ in the final clause (shown in bold), confirming that a knowledge-related meaning of the vision verb is prominent. The translation gives an English approximation of the extended meaning of the perception verb (also in bold).

- (1) *ónene tsyè í-tá-tè pò xé gĩ be-tşĩñĩ wɔ*
 nobody too CN1.SG.NEG-INT-know but if when C1.PL.PFV-send 2SG
for bidéya test aotoe when bià-mò şĩ poison
 for thing:PROX test autopsy when C1PL.POT-**see** that poison
 ‘Nobody too will know, but if they send you for this autopsy thing then they’ll **know** that it was poison.’ (Ava_089/RD.SvP)

As noted in Section 2.2, the translation does not mean to imply that a perceptual meaning is absent; only that an extended meaning is (also) present. In (1), a literal visual meaning is also potentially active for *mə*, along with the cognition-related meaning, as the medical team may be using visual evidence in their assessment. Other cognition-related examples encountered in the data highlighted the relevance of vision to features such as factivity and to mental operations like numerical calculation. Spanish *ver* ‘see’ is further attested with a mental quotative function, that is, introducing the thoughts of the speaker.

Sight verbs associated with meanings of focused attention, such as ‘checking on’ or ‘looking after’, were also found in all languages. A common context for attentional meaning was in guarding against hazards, as in example (2) from Whitesands, where the addressee is urged to attend carefully to their belongings. Literal perception was, again, often co-present with such meanings in the database.

- (2) *Na-t-ə-eru* *naw t-iet* *ko* *iken mənq*
 2-PROG-SG-**see/look** knife 3SG.NPST-exit PROXIMAL place and
tapaka
 tobacco

‘You should **watch out** in case the knife comes out [i.e., falls out of the addressee’s bag] or the tobacco.’ (Whi_97/JH)

In addition to cognitive and attentional meanings, sight verbs in diverse languages were readily recruited into expressions of socializing (8 out of 13 languages). In more than half the languages, sight verbs were extended to mean locating something (for example, in a Siwu conversation about searching for a lost child), while vision-based expressions of trying (typically in multi-verb constructions) were found in 5 languages. Vision verbs in four languages described instances of subjective co-identification (or its absence, as in the English example, *I never **saw** it as a radish* Eng_067/KK).

To summarize the crosslinguistic trends, Table 2 shows the extended meanings present for vision verbs in the thirteen investigated languages, according to the meaning groups in Table 1. As noted previously, while recurrent patterns are noteworthy, we cannot conclude anything definitive from absence of attestation. A more in-depth investigation of individual languages is warranted to make such conclusions. Nevertheless, the sheer ubiquity of cognition and attention meanings co-present with sight verbs is remarkable.

Aside from the recurrent meanings identified in Table 2, the data included seven uses of sight verbs that were unique to a single language (Supplementary Materials: S10–S16). In four cases, these meanings correspond to extensions

Table 2: Recurrent semantic associations for sight verbs. Gray indicates a meaning of this kind was attested in the conversational data.

	Avatime	Cha'palaa	Chintang	Duna	English	Italian	Lao	Mandarin	Semai	Siwu	Spanish	Tzeltal	Whitesands
COGNITION													
ATTENTION													
SOCIALIZING													
LOCATING													
TRYING													
CO-IDENTITY													

reported for other languages (detailed in the supplementary materials). Mandarin *kan* ‘look’ is used to mean ‘read’, while in our English data, *see* is used to mean ‘experience’. The three remaining meanings (Chintang ‘video-record’, English ‘express to’, and Mandarin ‘depend on’) have not to our knowledge been described for other languages.

We turn now to the complex issue of discourse uses of vision verbs, where perception predicates are employed to manage interaction as it unfolds. Sight verbs were identified as occurring with a discourse function in ten out of the thirteen languages, the three exceptions being Cha'palaa, Chintang, and Lao (the languages with the lowest frequency of perception verbs overall). We discuss two examples here using a conversation analytic approach, taking the opportunity to examine the broader sequential context of the data and the intersubjective demands of conversation.

As a precursor, we note the importance of directives (typically, sentences that are formally imperative) to discourse uses of perception verbs. Perception imperatives typically attempt to direct an interlocutor's attention towards an object in the environment. This can be in the service of various actions, for example, to give a warning, as already seen in (2), or to elicit an assessment, as in (3) from Italian. In this extract, Rita uses *guardare* ‘look’⁵ to draw the attention

5 As pointed out by a reviewer, *guardare* originates as a borrowing from Frankish *wardōn ‘guard, protect’ into Medieval Latin. This illustrates that literal perception may not always be the original meaning of what is synchronically a perception verb, albeit one that maintains (or,

of her companions to an aeroplane overhead (see also Waltereit 2002). The imperative, together with the exclamation *what an airplane*, conveys the speaker's evaluative stance toward its object as especially noteworthy. Bea then responds with a second assessment (*madonna!*) that aligns with the first (cf. Pomerantz 1984).

- (3) Rita: **guardate** *che mm* ((points)) *aereo*
 look.IMP.2PL that/what airplane
 ‘**Look**, what an airplane!’
 Bea: *madonna*
 ‘Good heavens!’ (Ita_046/GR)

Examples such as (3) illustrate how perception imperatives can set up triadic engagement through direction of another's attention toward an object. The directive redistributes epistemic access (Heritage and Raymond 2005): the recipient now has a basis to know what the speaker knows, putting the object into common ground (Clark 1996). In (3) the triadic engagement further serves to create a “stance triangle” wherein two speakers' evaluative stances converge in intersubjective alignment (Du Bois 2007).

It is a short step from jointly attending to objects in the environment to mutual appraisal of the conversation itself (cf. Fagard 2010: 262). Thus, a sight verb can be used to direct the addressee's attention towards spoken words in actions that seek to attain or maintain alignment between interlocutors. Example (4) from Duna occurs in the context of a dispute. This dispute concerns the number of pigs that an affiliated clan has available to contribute to a joint settlement of a legal case. At the beginning of this extract Tomas – a farmer from the local clan – asserts that the affiliated clan has three pigs to contribute, for a total of six pigs between the two clans, as mandated by the court. While Peter agrees, Josiah disputes this assertion, claiming that the affiliated clan does not have three pigs to give.

- (4) Tom: *ita itupa epara si hoayanua*
 ‘So say they [the affiliated clan] bring three
 itupa hongsa sayeta ita raka
 Then three pigs from here makes six.’

arguably, re-invigorates) earlier non-perceptual senses. However, while attentional meanings such as ‘take care of’ and ‘guard’ are listed as meanings of *guardare* in standard Italian dictionaries, such meanings did not occur in our data sample; the ATTENTION meaning noted for Italian in Table 2 is a use of *vedere* to mean ‘check’ (Ita_043/GR).

- Pet: *hame*
 ‘It’s like that.’
- Tom: *a/yu...*
 ‘Now...’
- Jos: *[epara itupa neyaniania*
 ‘They do not have three pigs over there!
ko ha-ta ndu riya koya
 But you’re still talking about that.’
- Tom: *hanani ho ri hoyanua ruwa*
 ‘That’s all, this is what we’re saying,
ita raka-na inu-ka sa-yanua ke-pa
 pig six-SPEC 1/2PL-ERG get-SNS.IMPL **see/look-IMP**
 we’re talking about getting the six pigs, **look!**’ (Dun_188/LSR)

In a dispute, participants put forward and defend mutually exclusive versions of reality (e.g., either a clan has three pigs or it does not), and work towards a resolution of such reality disjunctions whereby one version of reality prevails (Pollner 1987). In (4) the verb *kepa* ‘look’ is the final component in a turn that moves to resolve the dispute through a reformulation of the current activity (“we’re talking about getting six pigs”), from one that can be disputed (the number of pigs the affiliated clan will contribute) to one that cannot (the number required for the settlement). Thus, just as *kepa* can direct the attention of the other to an object in the environment, so too can it appeal to the other to ‘look’ and ‘see’ a spoken version of the world that he or she apparently has not recognized.

Summing up, a link between vision and cognition was found across all languages in the sample. Less commonly explored in cross-linguistic perspective — but with a strong presence in conversation in diverse languages — was the association between vision verbs and attentional meanings, and the use of vision verbs as discourse markers to manage attention and intersubjective alignment in ongoing interaction.

3.2 Hearing

For hearing verbs, our pool of relevant languages shrinks to eleven, as Tzeltal and Duna do not have audition-specific verbs (these languages are considered in Section 3.4). For the meaning groups in Table 1, only cognition and attention associations were attested for hearing verbs (see Table 3). In almost all cases these extensions simultaneously related to linguistic communication

Table 3: Recurrent semantic associations for hearing verbs. Gray indicates a meaning of this kind was attested in the conversational data. (Duna and Tzeltal do not have hearing-specific verbs.)

	Avatime	Cha'palaa	Chintang	Duna	English	Italian	Lao	Mandarin	Semai	Siwu	Spanish	Tzeltal	Whitesands
COGNITION				X								X	
ATTENTION				X								X	

(cf. Sweetser 1990). (More examples of hearing verbs are shown in Supplementary Materials: S17–S21.)

Audition verbs were noted as having cognition-related meanings in three languages. In English and Lao, the examples arose in the context of hearing speech as a way of coming to know something. In Siwu, the verb *nɔ* ‘hear’ was used to mean ‘understand’, in the context of understanding a language (5).

- (5) ðʏɛ kere má ʏɛ sɪ- sɪdàbɛ dzɛ támà ʏɛ
 PFOC.speak just 3PL speak Si- Sidabe which PROG.3PL speak
 lei to lo **nɔ** inɛ̀ɛ tà mà ʏɛ
 1SG.NEG PROG 1SG **hear** that.which PROG 3PL speak
 ‘Talking their Sidabe language that they talk, I don’t **understand** what
 they are saying.’ (Siw_074/MD)

The overlap between hearing and cognition that arises in the context of comprehending a language is widespread (see also Vanhove 2008; Aikhenvald and Storch 2013), and such uses have indeed been suggested as an important bridging context to other cognition meanings for audition terms (e.g., Evans and Wilkins 2000).

Attentional uses for hearing verbs, found in seven of eleven languages, concerned closely attending to speech and heeding another’s words (with one exception, see Section 3.5). The playful Mandarin exchange shown in (6) illustrates one such case.

- (6) Greg: *wo gen ni jiang duo haochi jiu shi duo haochi.*
 yao xiangxin wo yao xiangxin wo.
 ‘[If] I tell you it tastes good then it tastes good. You need to believe
 me.’

Alan: *en.*

‘Mm’

Greg: *jingli jiang hua yao ting, hao bu hao.*
 director talk speech want **hear/listen** good NEG good
 ‘When the director talks, you **heed**, okay?’ (Man_035/KK)

The presence of recurrent meanings in the database (according to the domains identified in Table 1) is summarized in Table 3. While we do not see the same coverage as for vision verbs, the domains of cognition and attention are nevertheless represented across several language families, with attention particularly prominent.

As well as the recurrent meanings investigated, three unique extensions of hearing verbs were noted (see Supplementary Materials: S19–S21). Two of these were constructional, with the hearing verb used in combination with a verb of speaking to express specific types of linguistic communication: ‘tell’ in Lao, and ‘ask’ in Cha’palaa. The Lao material also included *ñin2* ‘hear’ meaning ‘audio-record’, an auditory parallel of Chintang *copt* ‘see/look’ as ‘video-record’, mentioned above.

Four languages (English, Italian, Siwu, Spanish) had examples of hearing verbs used with a discourse function. These verbs were all used to talk about perceiving the speaker’s upcoming or just prior talk, and were almost exclusively imperatives. An example from Spanish, recorded in a home in Bogotá, is shown in (7). Here, Xavier is involved in a lively discussion with another speaker, Juan. Simultaneous with an exclamation from Xavier, Alex (their host) addresses Xavier and Juan with the preface *oiga niños* ‘Listen guys’⁶ and goes on to remind them of their intention to visit the National Museum today: time is running short, and if they want to get to the museum they should leave soon.

- (7) Xav: *Eso es lo que estaba pensando justo yo ahorita*
 ((to Juan)) ‘That’s what I was thinking just now!’
Que hecho, estoy como [(noise of exclamation)
 ‘How crazy, I’m like (exclamation)’

⁶ *Oiga* is the ‘polite’ imperative form of the verb. However, in Colombian Spanish of Bogotá it is quite typical to use polite second person forms between friends, rather than the informal forms, which have a more restricted function in marking definite intimacy (e.g., between parent and child, or spouses).

Alex:

[*Oiga**niños***hear**.IMP.PLT

boy.PL

'Listen guys*No es por echarlos pero si quieren ir al museo nacional...*Not to kick you out, but if you're wanting to go to the National
Museum...' (Spa_082/EN)

Alex's use of *oiga* ('hear') agrees with Sidnell's (2007) analysis of *listen*-prefaced turns in English — which he argues "launch courses of action" — as Alex is initiating a suggestion that Xavier and Juan should leave; it also concurs with Pons Borderia's analysis of Spanish *oye* 'listen' as used to change topic or introduce a justification (1998; as cited in Tanghe and Jansegers 2014). In (7), Alex orients to potential breaches of intersubjective alignment as he gets this task underway. For starters, Alex must insert himself into an ongoing conversation, to the extent that he even produces his turn in overlap with Xavier. He begins his utterance with a direct bid for attention (the audition verb itself) and a vocative nominal (*niños*, 'guys') that explicates who the listeners should be, signaling that Xavier and Juan now need to reconfigure the participation framework to include Alex. He then continues with the potentially interpersonally fraught task of suggesting that his visitors leave. Alex mitigates the possible fallout of this action through his preamble ('Not to kick you out, but...'), his focus on Xavier and Juan's desires ('you're wanting to go...'), and his use of the conditional 'if' (downgrading his own epistemic authority and implying that the final decision rests with the addressees). The interaction appears to be rich in possibilities for misunderstanding and misalignment, and *oiga* is part of Alex's defense against these risks. This example illustrates how audition verbs can be deployed in conversational actions that are designed to secure attention and understanding.

3.3 Touch, taste and smell

Touch, taste, and smell terms were rare in our data and were generally used with a literal perceptual sense. However, even this very small sample of conversation furnished a few examples of these terms with cognition-related connotations, as well as instances of touch terms expressing meanings of emotion, control, involvement, and obligation (see also Supplementary Materials: S22–S25).

In the Spanish data the experience of being touched was equated with experience and knowledge of something (8). Two friends are talking about a soap opera from the 1980s.

- (8) *se acuerda, usted le tocó eso o no?*
 REFL remember, 2.SG.POL 3SG.DAT **touch**.PST that or not
 ‘Do you remember, did that one **become known** to you or not?’
 (Spa_006/EN)

Taste and smell tokens in the database all referred to literal taste and olfaction. However, this could additionally be in the context of mental processes such as recognizing someone or finding something out, thereby showing a potential association with cognition. In Duna, the verb *kori-* ‘smell’ was used twice to describe how pigs are able to identify their owners by smell (9). In this conversation, the ability was being discussed as evidence of the superior mental ability of pigs (as opposed to other animals), suggesting that the sense of smell can be understood as indirectly relating to cognitive functions.

- (9) *puru-na pi kori-nda-na*
 body-SPEC LINK **smell**-INT-SPEC
 ‘A pig will **recognize** the body [of the person who is its owner]’.
 (Dun_150/LSR)

Moving on from uses that were related to cognition, English included one example that exemplified the link between touch and emotion (*You’re making me feel guilty* Eng_030/KK), as discussed by Sweetser (1990). In Spanish, *tocó* ‘touch’ was used on one occasion to express obligation. Two examples from Duna conceptualized ‘touching’ as exerting control, and as involving or talking negatively about a person. These latter three extended meanings of touch (‘oblige’, ‘have control over’, ‘involve’) relate broadly to affectedness as a common extension of tactility (Ibarretxe-Antuñano 2006).

In sum — despite the paucity of tokens — touch, taste and smell showed cognition-related meanings, specifically, knowledge and experience (touch), finding out (taste), and recognition (smell), while touch verbs in the database also gave evidence for the relevance of tactile expressions to emotion and to the interpersonally charged domains of deontic modality (obligation) and affectedness.

3.4 Multi-sense terms

Multi-sense verbs (Table 4) are those that can be used to express a range of sensory meanings (excluding temperature and proprioceptive meanings, which are not considered here). For the purposes of our study we interpret the verbs in Table 4 as having lexicalized multi-sensory potential, as distinct from more *ad-hoc*

Table 4: Multi-sense terms in the data sample (adapted from San Roque et al. 2015; a dashed line delineates default meanings, where relevant).

	Avatime	Duna	Italian	Semai	Spanish	Tzeltal	Whitesands
SIGHT							
HEARING	<i>nu</i>	<i>waki</i>	<i>sentire</i>				<i>tetou</i>
TOUCH				<i>rasaak</i>	<i>sentir</i>	<i>a'y</i>	
TASTE							
SMELL							

occurrences of intrafield polysemy (see Section 3.5). (Additional examples showing multi-sense verbs are available in the Supplementary Materials: S26–S37).

The Avatime, Duna, Italian, and Whitesands multi-sense verbs have a default association with hearing. The Semai verb *rasaak* ‘touch, taste’ and Tzeltal verb *chiknaj* ‘perceive’ (both of which were quite infrequent, occurring four times each) were not attested with transfield semantic associations.

As for the modality-specific perception verbs, we first present examples of extensions that fit the meaning groups identified in Table 1 and collate the cross-linguistic results (Table 5). We then present language-specific extensions of multi-sense verbs, followed by contextualized examples of discourse uses.

Table 5: Recurrent semantic associations for multi-sense verbs. Gray indicates a meaning of this kind was attested in the conversational data.

	Avatime	Duna	Italian	Semai	Spanish	Tzeltal	Whitesands
COGNITION							
ATTENTION							
LOCATING							
TRYING							

Cognition-related uses of multi-sense verbs were attested in Avatime, Duna, Spanish and Tzeltal. In Avatime and Duna, cognition meanings of multi-sense terms were to do with the comprehension of language (cf. 5, above), whereas Spanish *siento* referred to impressionistic knowledge (in fact, similar to

cognition uses of English *feel*). Example (10) shows a case from Tzeltal where *a'y* 'sense' has the cognition meaning 'know'.

(10) *ma x-k-a'y-tik*

NEG ASP-1.ERG-**sense**-1PL.INCL

binti ya y-ak' y-ala ip j-teb-uk

what ICP 3.ERG-give 3.ERG-DIM strength one.NC-bit-SUBJ

'We can't **know** how it [a kind of medicine] gives a bit of strength.'

(Tze_337/PB)

Multi-sense terms in Duna, Italian, and Tzeltal had attentional associations. In Duna, the relevant example related to attending to speech (as per the audition verbs discussed in Section 3.2), while Italian *sentire* was used to describe focused attention to food (checking its readiness). For Tzeltal, the multi-sense verb *a'y* occurs with the meaning 'look after', used where the speaker talks about the importance of attending to the needs of others and propagating pro-social behaviour (11).

(11) *ja' ya s-k'an ya 'w-a'y tz'i me*

it's.that ICP 3.ERG-want ICP 2.ERG-sense PRT PRT

k'ux ya 'w-a'y a'-pat a'-xujk --

loving ICP 2.ERG-**sense** 2.ERG-neighbor 2.ERG-neighbor

'It's that you need, you see, to lovingly **look after** your neighbors.

ma ma j-le k'op-ok-at — ma xmilawanat ma x'elk'ajat ma xa'pas mul

'Don't look for a fight — don't go around killing, stealing, doing bad things.' (Tze_122/PB)

Meanings about locating things and about trying recurred across the vision verbs in our data (Section 3.1). There was also one instance of a multi-sense term being used with a locating meaning, found in Whitesands, and one instance of a *sense* > *try* extension, found in Tzeltal.

Table 5 summarizes the semantic extensions of multi-sense terms presented so far. While only a few languages attest relevant meanings (much fewer than, for example, sight verbs), four different meaning groups are represented, suggesting greater semantic range than hearing verbs.

Moving beyond the familiar extensions in Table 5, six unique meanings of multi-sense verbs were also identified (Supplementary Materials: S32–S37). The Duna multi-sense verb can mean 'ask', while Italian *sentire* can be used to describe remote communication, similar to English expressions such as 'hear from'. These examples hark back to the connection between hearing verbs and linguistic communication (§3.2). Showing off an impressive semantic range, Tzeltal *a'y* 'sense' was used in

descriptions of physical pain, of inclination (e.g., to feel like doing something), and emotional disposition, as well as occurring in construction with nominal phrases to mean ‘undertaking’ or ‘doing’ something. Overall, these data suggest that multi-sense terms in conversation have complexes of meanings that differ from language to language, but in many cases show a relationship to modality-specific polysemies that have been reported for other languages (e.g., audition > understanding, as already discussed; or touch > pain and taste > preference, identified as common extensions by Sweetser 1990).

As well as showing a wide array of transfield meanings, multi-sense perception verbs can be used with discourse functions. We found that speakers of Avatime, Duna, Italian (see Enghels and Jansegers 2013; Tanghe and Jansegers 2014), Tzeltal, and Whitesands all used their multi-sense verbs to manage aspects of the conversation. Example (12), from Avatime, illustrates the discourse use of a multi-sense verb in a directive. The verb is used to redirect the trajectory of a course of action in conversation, and simultaneously prepare the addressee for the upcoming shift. Anna has come to Caro’s beauty salon in southern Ghana to try on a new wig in preparation for a funeral. For Anna, the wig represents a substantial financial investment and in this sequence, after a lapse in the conversation of over 13 seconds (not shown), Anna expresses what we might call buyer’s remorse. Using the multi-sense perception verb *nu* (translated here as *listen*) the hairdresser redirects the line of talk away from Anna’s troubles and invites a more positive assessment of her current situation.

- (12) Anna: *nyà (xxx) mɔ-kɔ to fufu ɲa ɓi-pɛ sanɔ*
 ‘If I’d used the money to pound *fufu* and eat, it would have been better.’
 Caro: *wɛɛ-nu = i*
 2SG.PROG-**sense** = CM
 ‘**Listen.** (1.5)
Wɛɛ-nu = i
 2SG.PROG-**sense** = CM
Listen. (2.3)
kɔ ɡĩ bi-tsyi wɔ a-ɲwɛnamɛ te
 The way it’s changed your face
bĩ-ɓi-pe wo di
 isn’t it nice for you?’ (Ava_073-074/RD.SvP)

Anna’s statement is an example of what Jefferson (1984) has identified as a “troubles telling”, which makes relevant a range of possible next actions, such as an expression of empathy or a solution to the trouble (cf. Kendrick and Drew

2016). However, the response that the hairdresser (Caro) provides departs from this trajectory and instead solicits agreement to a positive assessment of Anna's appearance, thereby shifting the course of action from commiseration to celebration. Such discontinuity can be a source of misalignment in that a recipient may be unable to anticipate and thus may fail to recognize the next action (e.g., an "out of the blue" change in topic; see Drew 1997). Caro's use of the perception verb in (12) is remarkably similar to a practice described for English, whereby turn-initial *look* "serves to mark a disjunction and redirection of the talk away from the conditionally relevant next action and towards some alternative" (Sidnell 2007: 387). Thus, these perception verbs help to manage and align the expectations of interlocutors concerning the course of their talk together.

Moving away from the discursive directives examined so far (see 4, 7, 12), a prominent use of the Tzeltal multi-sense verb *a'y* was to register information and express understanding of a prior speaker's talk (13). In this example, Agustín asks the whereabouts of his uncle (also a kinsman of Nicolás, Agustín's interlocutor). After several intervening turns, *wa'y* acknowledges that an adequate response has been given, moving the sequence to a close.

- (13) Agus: *ja' tz'i jtajun i ba' bajt?*
 'As for my uncle, where's he gone?' (0.6)
- Nico: *bajt ta p'is k'inal*
 'He's gone to measure his land.'
- Agus: *banti xkal?*
 'Where?' (0.9) ((Nico points towards Xixintonil))
- Nico: *ta (.) xixintonil laj sk'inal laj eskuela*
 'To Xixintonil they say, to the school's land they say.'
- Agus: *jej. xixintonil [to*
 'Eh? (0.7) All the way to Xixintonil.'
- Nico: *[joo*
 'Yeah' (0.8)
- Agus: *li' ba[jt tz'in bi* ((pointing toward Xixintonil))
 'He went this way?'
- Nico: *[sok laj ch'ulja' ya'tik*
 'And to Ch'ulja' now' (0.2)
- Agus: *eee w-a'y*
eh 2.ERG-sense⁷
 'Ehh, [I] understand.'

⁷ *wa'y* is composed of the verb inflected with a second person marker (that is, it could literally be translated as 'you sense'). However, as a conventionalized phrase in context it conveys that the situation is sensed/understood by the speaker.

Nico: /joo
 ‘Yeah’ (Tze_127/PB)

After Nicolás first answers the question, Agustin initiates repair, treating the answer as inadequate. After Nicolás gives more information concerning the uncle’s location, Agustin again initiates repair with an interjection *jej* ‘eh?’. After no response comes, he initiates repair again with a repetition of the place name *xixintonil* together with an insertion of the particle *to* ‘up until’. Both the prosodic composition of *jej* and the semantics of the particle *to* display the speaker’s surprise or disbelief at the information — a recurrent use of other-initiations of repair (see, e.g., Selting 1996 on German). Such practices of repair usually serve as what Schegloff (1992) calls a “defense” of intersubjectivity in conversation. Misunderstandings, whether due to troubles of hearing, understanding, or believing, constitute one recurrent basis for misalignment between participants. In this case, after Nicolás eventually provides additional information about the location of the uncle, Agustin registers the information with *wa’y*, displaying a change of epistemic status (cf. Heritage 1984). This information uptake treats Nicolás’ solution to the trouble as adequate, restores intersubjective alignment, and brings the question-answer sequence to a close. The use of a perception verb to register information has an analogue in English *see* in a phrase like *I see*, which can also occur in a similar position, following an adequate answer to a question.

Overall, multi-sense terms complicate the investigation of sensory polysemy, as we cannot always trace a clear relationship between one particular sensory modality and its associations; perhaps it is not appropriate to think of things in terms of single sensory modalities at all (e.g., Lynott and Connell 2009). While many of the extensions we see are familiar, they are not always those we might expect. In several instances, multi-sense verbs have extensions more typically found with *sight* verbs in other languages, including cognition, attention, locating and trying, as well as the use as a discourse marker denoting information uptake (i.e., parallel to English *I see*). This would seem to argue for a relatively holistic view of sensory perception as a source domain for semantic and pragmatic extensions, as cross-linguistic correspondences are found across, as well as within, modalities.

3.5 Suggestions of intrafield extension

We turn, finally, to a handful of cases that reveal another layer of complexity in the conversational data (see also Supplementary Materials: S38–S39). A close

cousin to the phenomenon of multi-sense verbs are more *ad-hoc* cases of intra-field polysemy, where a verb that usually refers only to a single modality is extended to refer to other perceptual experiences — for example, the use of a vision term with an aural percept as its object. One can view multi-sense verbs and intrafield polysemies as being at different points on the same continuum, as for both phenomena we see a single verb that is used in reference to more than one sensory modality. For comparative purposes, we have talked about multi-sense verbs where a multi-sense interpretation is relatively routine (e.g., speakers accept the word can refer to different perceptual modalities), and is not restricted to highly specific constructions or contexts. However, cross-modal interpretations can also be the spontaneous product of a specific context rather than a (relatively) stable feature of the verb's meaning. Such examples suggest bridging contexts for the development of multi-sense terms in a language's perception lexicon (cf. Evans and Wilkins 2000).

In six languages a vision verb was used with someone speaking (or speech itself) as the object of perception, as in (14) from Siwu. In such cases, we can readily interpret the sight verb as conveying auditory as well as visual sensory experience. (These potential intrafield extensions are expressed in the translation line in square brackets.)

- (14) ɔ-ò-**nya** gɔ́ tá mà yéré mɛ
 2SG-PFV-**see** how PROG 3PL tell 1SG
 sɔ kà mà qí mɛ fòtò!
 QUOT ING 3PL take 1SG picture
 'Have you **seen** [**heard**] that they are telling me that they are taking my picture?' (Siw_091/MD)

The situation exemplified in (14) suggests one plausible bridging context for how a sight verb could start to take on a hearing meaning. Speech is an activity that, for non-signed languages, has audition as its most salient property, and it is possible that referring to direct (visual) perception of speech could shade into reference to aural perception. However, the question of why a speaker actually uses a sight verb in this context remains open. A plausible hypothesis is that in an example like (14) what is evoked is not (just) perceptual meaning, but also a transfield meaning, for example, relating to knowledge or attention.

In support of this, other intrafield extensions of sight verbs in the database also appear to come about through transfield polysemies, as in (15) from Semai.

- (15) *mín haliij n-nɛ:ŋ gɛ? nu = blɔ:?*
 when alone 1SG-**see/look** a.little LAT = where

$\mathcal{P}_i = s < ra > \tilde{\epsilon}:k$

TPC = to.smell.foul/rank < EVNT.PL >

‘When alone, I **searched for [smelt]** the bad-smelling places.’ (Sem_057/ST)

In (15), a potential smell meaning for the vision verb *νεεη* arises because of the olfactory nature of the percept in a situation where *νεεη* is used with a locating meaning (‘search for’); so the transfield meaning provides the bridge to a potential intrafield meaning. Similar examples are found in Spanish, where *ver* ‘see’ is used to talk about finding out about the taste of food; and in Whitesands, where the verb *teling* ‘listen’ is used to talk about paying attention to a tactile percept (the tug of a fishing line).

The intrafield polysemies attested in the database (sight > hearing, smell, taste; and hearing > touch) agree with Viberg’s (1983) hypothesis that sense extensions will be unidirectional, moving from higher to lower on his proposed hierarchy (see > hear > touch, taste, smell), also supported by Evans and Wilkins’ (2000) findings. In addition, we argue that intrafield polysemies are generally facilitated by *transfield* use (cf. Viberg 1983: 140–141).

4 Discussion

The potential for a word to express different but related meanings remains an abiding but incompletely understood facet of human language. The polysemy of basic perception verbs is a classic testing ground for the investigation of universal and culture-specific forces in language and cognition, and in this study we take a step forward by examining what extensions of this domain are, in fact, encountered in everyday interaction across diverse languages. We find a high level of agreement in conversational corpora for the extended uses of basic sensory verbs, as well as evidence of their rich semantic and pragmatic range. Conversation can ground claims from the literature in what people from diverse linguistic backgrounds actually say and do day-to-day.

Strikingly, even small slices of interaction from very different languages and cultures all show evidence for a lexicalized link between sensory experience and cognition. Using verbs that describe perception to talk about knowledge, discovery, thought and understanding is not only possible in language, it is also a typical feature of spontaneous dyadic or multi-party language in different cultures. Evidence from conversation suggests that visual and other sensory experience is also construed as emblematic of attention. The data further support claims that verbs of sight are likely to be used to talk about the social domain

(e.g., Aikhenvald and Storch 2013), while the association of vision with potentiality and with the expression of subjective stances suggests intriguing areas for further cross-linguistic inquiry. Uses of hearing verbs (and certain multi-sense verbs) in spontaneous conversation confirm that audition has a special association with linguistic communication, as transfield meanings related almost exclusively to speech and communication (e.g., ‘understand’, ‘ask’, ‘tell’). The representation of speech as an aural percept seems likely to have a profound impact on the emergent semantics of auditory verbs, as well as multi-sense verbs.

Almost all of the languages studied evince the role of perception verbs in discursive practices; for example, through directing attention to upcoming talk. While the precise discourse functions of perceptual vocabulary across languages are yet to be subjected to comprehensive and systematic study, our database establishes the relevance of vision, audition, and multi-sense verbs to the management of everyday linguistic interaction in a range of cultural settings beyond the well-known languages of Europe.

Turning to intrafield extensions, the conversational data support Viberg’s claim that sight verbs generally undergo semantic shifts to “lower” sensory modalities. More intriguingly, our data suggest that transfield meanings are important to the development of intrafield polysemies (and eventually multi-sense terms), pointing to the necessary role of encultured language use — in particular conversation — as the medium for proposed psychophysical influences on semantic change (Evans and Wilkins 2000).

The cross-linguistic prevalence of several of the meanings and functions discussed here — that is, the evidence that they are activated in everyday conversation in very different cultural-language environments — spotlights the question of whether these semantic associations tap into some kind of cognitive universal. For example, perhaps the connection between perceptual and cognitive meanings is motivated by a common, embodied experience of transforming sensory stimuli into mental objects, and this is what drives their robust recurrence. While possible, this proposal is still distinct to those proposed previously. A complementary theme is how the language of perception connects to potential universals of human sociality. On one level, this is evident in the common semantic associations of vision terms with social interaction, and of hearing and multi-sense terms with the social activity of linguistic communication. In addition, perception terms are used as discourse markers to establish joint attention, redistribute epistemic access, and manage intersubjective alignment between conversation participants. Such interactional and discourse motivations may well conspire with cognition and culture to effect semantic change, in turn supporting the development of attentional and epistemic meanings for sight,

hearing, and multi-sense verbs. So, the same word may be used not only in relating perceptual, and by extension, cognitive activity, but also in registering new knowledge in the moment; or to direct attention not only to avert a physical threat in the environment, but also to avoid a potential rift in interpersonal accord. Engagement with interactional dynamics — as well as a backdrop of shared psychophysical experience — appears likely to shape the use of perceptual language across diverse linguistic and cultural settings.

In sum, even small amounts of conversational data display a broad spectrum of meanings for perception verbs, many of which are astonishingly uniform across samples from diverse cultures. To explain these findings, the possibility of interactionally-driven universals adds a new dimension to the dichotomy of cognitive universality versus cultural relativism (as per Levinson 2006; Kendrick et al. 2014). The language of perception is likely to be an important tool for coordinating joint attention, sharing experience and calibrating knowledge across interlocutors, including awareness of linguistic communication itself (Majid and Levinson 2011; San Roque et al. 2015). While culturally, linguistically and environmentally mediated, these basic practices are central to human interaction in general, putting social motivations front and center as a further source for universal semantic associations.

5 Conclusion

Three features of the conversational data manifest a general conceptual link between perception and cognition (Ibarrexe-Antuñano 2008). First, all languages show co-lexification of perception and cognition-related meanings in typical language use. Second, this is found not only for sight verbs, but also for hearing and multi-sense verbs in certain languages, and even to some degree for verbs of touch, taste and smell. This highlights the need for further in-depth language-specific study of the lexical associations and cultural conceptions of the “lower senses” of touch, taste and smell (see, e.g., Backhouse 1994; Burenhult and Majid 2011; Storch 2013). Third, the fact that vision verbs and (non-visual) multi-sense verbs share several semantic and pragmatic associations supports the treatment of perception as a unified domain for extension. The connection between hearing verbs and linguistic communication is likewise supported by the conversational data, but with the important reminder that multi-sense verbs also participate in this semantic domain.

Overall, vision verbs in all languages, as well as some hearing and multi-sense verbs, colexified both attentional and/or cognitive meanings. Such

meanings link to attentional and epistemic discourse actions, whereby participants redirect attention to objects in the environment, signal shifts in the trajectory of talk, and register changes in their own states of knowledge. We found that sight, audition, and multi-sense verbs were all used with discursive functions, ultimately in service to the establishment, maintenance or repair of intersubjective alignment between conversational participants.

Intrafield extensions of vision and audition verbs in conversation point to a potential paradox in the language of perception. Evans and Wilkins (2000: 547) concluded that constraints on intrafield extensions in the sensory lexicon are determined by “neurophysiological givens (the structure and experience of basic perception)”, in contrast with transfield extensions, which may be more open to cultural variation. The specific case they discuss is the way that particular cultural factors, for example, the primacy of oral (as opposed to written) transmission of knowledge, or the (potentially negative) marked nature of sustained direct eye contact in social interaction, contribute to the semantic extensions of audition and vision verbs (Evans and Wilkins 2000: 580–585). Ultimately, they argue that “the same domain [i.e., perception] can have its ‘universal’ and ‘relativistic’ sides; a foot in nature and a foot in culture” (Evans and Wilkins 2000: 546). Our findings suggest that universal patterns (the direction of intrafield extensions) are nevertheless reached via what have been supposed to be culturally-mediated pathways (i.e., transfield extensions); or, in other words, it may be culture that opens the door to nature. This serves as a reminder that even the most widespread of semantic associations must come about incrementally, through contextualized interactions between encultured individuals using a specific language. As such, any universal polysemous meanings must arise not in opposition to diversity, but rather dwell within it.

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Abbreviations and conventions:

Annotations following examples show the language (identified by the first three letters), the number of the example in the database (from San Roque et al. 2015), and the initials of the contributing researcher(s). In some longer examples, the duration of pauses (in seconds) are noted in parentheses. Overlapped elements of speech are indicated using a square bracket in the original language line to show the point where overlap between speakers commences. Notation concerning participants' actions (e.g., pointing) are enclosed in double parentheses. In the interests of space we give an interlinear gloss only for lines that include a perception verb. In translation lines, an English approximation of the transfield association of the perception verb is shown in bold. This is not intended to exclude the possibility of a co-present literal perception meaning. For intrafield associations, extended meanings are shown in square brackets.

Interlinear gloss abbreviations are:

1	first person
2	second person
3	third person
ASP	neutral aspect marker
CM	clause marker
C _{NUMBER}	noun class
DAT	dative
ERG	ergative
EVNT.PL	event plural
ICP	incompletive aspect
IMP	imperative
INCL	inclusive
ING	ingressive
INT	intensive
LAT	lative case
NC	numeral classifier
NEG	negation
NPST	non-past
PL	plural
PLT	polite
P.FOC	predicate focus
PFV	perfective
POT	potential
PROG	progressive
PROX	proximal demonstrative
PRT	particle
PST	past
QUOT	quotative

REFL	reflexive
SG	singular
SNS.IMPL	impersonal sensory evidence
SPEC	specific
SUBJ	subjunctive
TPC	topic

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